

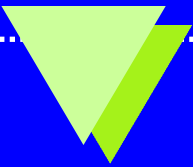


Chapter 5

The Inspection



Retail Motor-Fuel Dispensers



Chapter 5 - Objectives

- **Review the Examination Procedure Outlines (EPOs) for retail motor-fuel dispensers (RMFDs)**
- **Describe major elements of inspection**
- **Describe routine inspection procedures**



Systematic Approach to Inspection & Testing

- **Complexity of the RMFD system**
 - number of individual system components
- **Systematic approach provides for:**
 - efficient
 - effective
 - complete and consistent testing
 - collection of valid data



Legal Requirements

- All States use NIST Handbook 44
 - General Code (1.10)
 - Liquid-Measuring Devices Code (3.30)
 - some W&M use earlier or modified H44 versions
- Additional requirements
 - State laws and regulations
 - jurisdiction policies



Examination Procedure Outlines (EPOs)

- Organize requirements in format more suited to field use
- Include safety-related information
- Minimum examination procedures
 - additional procedures
 - ✧ new technology
 - ✧ complaint
 - ✧ improper use of device



Field Examination

- Inspection
 - compliance with specifications & other requirements
- Pretest Determinations
 - correct application of tolerances, test factors
- Test
 - compliance with performance requirements
- Evaluation
 - analysis of results to determine approval or rejection



Organization of EPOs 21 & 22

- Safety Notes
- Inspection
 - general considerations
 - indicating/recording elements
 - marking
 - measuring elements
 - discharge hose
 - totalizers
- Pretest Determinations
 - tolerances
 - product storage ID
- Test Notes
 - procedural guidelines
- Test
 - accuracy
 - RFI/EMI
 - antidrain means
 - zero-setback interlock
 - power loss
 - security means
- Evaluation



Inspection

- determine compliance with specs & other requirements (design, installation, operation)
- not limited to visual examination.....may need to verify through test or other determination
- Extent & emphasis of inspection depends on:
 - familiarity with the device
 - age of device
 - whether or not device NTEP approved
 - whether or not complaint was received



General Considerations

- H44 General Code (Section 1.10) Includes:
 - accessibility
 - assistance
 - selection
 - installation
 - position
 - use & maintenance



G-UR.2.3. Accessibility

G-UR.2.3. Accessibility for Inspection, Testing, and Sealing Purposes. - A device shall be located, or such facilities for normal access thereto shall be provided, to permit:

- (a) inspecting and testing the device;
- (b) inspecting and applying security seals to the device; and
- (c) readily bringing the testing equipment of the weights and measures official to the device by customary means and in the amount and size deemed necessary by such official for the proper conduct of the test.

Otherwise, it shall be the responsibility of the device owner or operator to supply such special facilities, including such labor as may be needed to inspect, test, and seal the device, and to transport the testing equipment to and from the device, as required by the weights and measures official.

(Amended 1991)



G-UR.2.3. Accessibility

- Access to equipment
 - includes RMFDs, consoles, other associated equipment
 - keys to cabinet
 - access to apply security seals & check audit trail info
 - transportation to remote locations
 - access to consoles, associated equipment
- Access to storage tanks
 - keys to fill covers
 - safe means to access above-ground tanks



G-UR.4.4. Assistance in Testing Operations

If the design, construction, or location of any device is such as to require a testing procedure involving special equipment or accessories or an abnormal amount of labor, such equipment, accessories, and labor shall be supplied by the owner or operator of the device as required by the weights and measures official.



G-UR.4.4. Assistance in Testing Operations

- Access to locked equipment
- Access to key-, card-, cash-activated dispensers
- Return of product to above ground storage



G-UR.1.1. Suitability of Equipment

Commercial equipment shall be suitable for the service in which it is used with respect to elements of its design, including but not limited to its weighing capacity (for weighing devices), its computing capability (for computing devices), its rate of flow (for liquid-measuring devices), the character, number, size, and location of its indicating or recording elements, and the value of its smallest unit and unit prices.

(Amended 1974)





G-UR.1.1. Suitability of Equipment

- Volume Indications
 - capacity for truck stops vs. cars & small trucks
- Price Computing Capability
 - retail service stations
 - adequate capacity for typical deliveries
 - range of unit prices
- Other Features



G-UR.2.1. Installation

A device shall be installed in accordance with the manufacturer's instructions, including any instructions marked on the device. A device installed in a fixed location shall be so installed that neither its operation nor its performance will be adversely affected by any characteristic of the foundation, supports, or any other detail of the installation.



G-UR.2.1.1. Visibility of Identification


Equipment shall be installed in such a manner that all required markings are readily observable.

(Added 1978)



G-UR.2.2. Installation of Indicating or Recording Elements

A device shall be so installed that there is no obstruction between a primary indicating or recording element and the weighing or measuring element; otherwise there shall be convenient and permanently installed means for direct communication, oral or visual, between an individual located at a primary indicating or recording element and an individual located at the weighing or measuring element. [See also G-UR.3.3.]





Installation - General Code

- **G-UR.2.1.**

- **installation according to manufacturer's instruction & marked instructions**
- **performance of device not affected by installation**

- **G-UR.2.1.1.**

- **equipment installed such that markings are readily observable**

- **G-UR.2.2.**

- **no obstruction between primary elements & W&M device**
- **indications on both sides of RMFD's**



UR.2.1. Manufacturer's Instructions

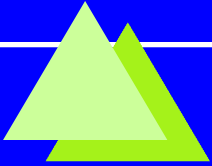
A device shall be installed in accordance with the manufacturer's instructions, and the installation shall be sufficiently secure and rigid to maintain this condition.

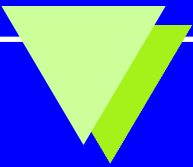
(Added 1987)



UR.2.4. Diversion of Liquid Flow

**A motor-fuel device equipped with two delivery outlets used exclusively in the fueling of trucks shall be so installed that any diversion of flow to other than the receiving vehicle cannot be readily accomplished and is readily apparent. Allowable deterrents include, but are not limited to, physical barriers to adjacent driveways, visible valves, or lighting systems that indicate which outlets are in operation, and explanatory signs.
(Amended 1991)**





Installation - LMD Code

- UR.2.1.
 - installed in accordance with mfg instructions
 - rigid and secure installation

- UR.2.4.
 - RMFDs with two delivery outlets to (exclusively) fuel trucks
 - ✧ deterrents provided to prevent diversion
 - physical barriers, valves, lighting systems, signs
 - ✧ simultaneous use does not facilitate fraud



G-UR.3.3. Position of Equipment

A device equipped with a primary indicating element and used in direct sales, except a prescription scale, shall be so positioned that its indications may be accurately read and the weighing or measuring operation may be observed from some reasonable "customer" position. The permissible distance between the equipment and a reasonable customer position shall be determined in each case upon the basis of the individual circumstances, particularly the size and character of the indicating element.

(Amended 1974)





G-UR.3.3. Position of Equipment

- Device positioned such that from reasonable customer position:
 - indications can be accurately read
 - measuring operation observed
- Primary indicator visible to customer & readable from customer position during:
 - reset to zero
 - all portions of delivery
 - when “on/off” switch is in “off” position



G-UR.3.1. Method of Operation

Equipment shall be operated only in the manner that is obviously indicated by its construction or that is indicated by instructions on the equipment.



G-UR.3.1. Method of Operation

- Equipment operated in manner indicated by construction or instructions on equipment
- Operation often obvious
- Some features may require instructions/markings
 - product selectors
 - payment selectors
 - self-pay devices (key, card, cash)



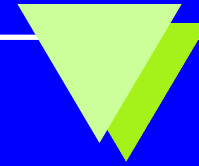
G-UR.4.1. Maintenance of Equipment

**All equipment in service and all mechanisms and devices attached thereto or used in connection therewith shall be continuously maintained in proper operating condition throughout the period of such service. Equipment in service at a single place of business found to be in error predominantly in a direction favorable to the device user shall not be considered "maintained in a proper operating condition."
(Amended 1973, 1991)**



G-UR.4.1. Maintenance of Equipment

- Owner required to maintain equipment
 - readability of indicating elements
 - accuracy of measuring device
 - repair/replace defective nozzles and hoses
 - repair of leaks
 - replace broken glass



G-UR.4.1. Maintenance of Equipment

- Factors to consider:
 - judgement required to apply
 - errors predominantly in favor of owner
 - ✧ includes errors within tolerances
 - ✧ majority of pumps in favor of owner
 - past compliance history
- Many jurisdictions have established their own guidelines for applying G-UR.4.1.





G-S.1. Identification

G-S.1. Identification. - All equipment, except weights and separate parts necessary to the measurement process but not having any metrological effect, shall be clearly and permanently marked for the purposes of identification with the following information:

- (a) the name, initials, or trademark of the manufacturer or distributor;
- (b) a model designation that positively identifies the pattern or design of the device;



G-S.1. Identification

(c) the model designation shall be prefaced by the term "Model," "Type," or "Pattern." These terms may be followed by the term "Number" or an abbreviation of that word. The abbreviation for the word "Number" shall, as a minimum, begin with the letter "N" (e.g., No or No.) The abbreviation for the word "Model" shall be "Mod" or "Mod."

[Nonretroactive January 1, 2003]

(Added 2000) (Amended 2001)

[Note: Prefix lettering may be initial capitals, all capitals or all lower case.]



G-S.1. Identification

(d) except for equipment with no moving or electronic component parts, a nonrepetitive serial number;

[Nonretroactive as of January 1, 1968]

(e) the serial number shall be prefaced by words, an abbreviation, or a symbol, that clearly identifies the number as the required serial number; and

[Nonretroactive as of January 1, 1986]

(f) the serial number shall be prefaced by the words "Serial Number" or an abbreviation of that term. Abbreviations for the word "Serial" shall, as a minimum, begin with the letter "S," and abbreviations for the word "Number" shall, as a minimum, begin with the letter "N" (e.g., S/N, SN, Ser. No, and S No.).

[Nonretroactive as of January 1, 2001]





G-S.1. Identification

(g) For devices that have an NTEP Certificate of Conformance (CC) Number or a corresponding CC addendum number, the NTEP Certificate of Conformance Number, which shall be prefaced by the terms "NTEP CC," "CC," or "Approval." These terms may be followed by the term "Number" or an abbreviation of that word. The abbreviation for the word "Number" shall, as a minimum, begin with the letter "N" (e.g., No or No.)

[Nonretroactive as of January 1, 2003]

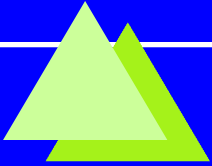
The required information shall be so located that it is readily observable without the necessity of the disassembly of a part requiring the use of any means separate from the device.

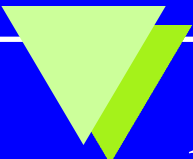
(Amended 1985, 1991, 1999 and 2000)



G-S.1. Identification



- Devices marked clearly and permanently
 - riveted metal badge or pressure-sensitive material
 - Markings required:
 - mfg/distributor name
 - model
 - preface identifying model number (NR 1/1/03)
 - serial number (NR 1/1/68)
 - preface identifying serial number (NR 1/1/86)
 - NTEP Certificate of Conformance Number, if applicable (NR 1/1/03)
 - Information must be visible after installation
 - without necessity of disassembly requiring tool separate from device
- 



G-S.1.1. Remanufactured Devices and Remanufactured Main Elements.

All remanufactured devices and remanufactured main elements shall be clearly and permanently marked for the purposes of identification with the following information:

- (a) the name, initials, or trademark of the last remanufacturer or distributor;*
- (b) the remanufacturer's or distributor's model designation if different than the original model designation.*


[Nonretroactive as of January 1, 2002]

(Added 2001)

Note: Definitions for “manufactured device,” “repaired device,” and “repaired element” are also included (along with definitions for “remanufactured device” and “remanufactured element”) in Appendix D, Definitions.




G-S.1.1. Remanufactured Equipment Markings

- Name, initials or trademark of last remanufacturer or distributor
 - Remanufacturer's model designation if different from original model designation
 - *Nonretroactive as of 1/1/02*
- 



S.4.1. Limitation on Use

The limitations on its use shall be clearly and permanently marked on any device intended to measure accurately only:

- (a) products having particular properties; or**
 - (b) under specific installation or operating conditions; or**
 - (c) when used in conjunction with specific accessory equipment.**
- 



S.4.1. Limitation on Use

- Requires marking of any limitations of use of device
 - if certain conditions required to ensure accurate and correct performance
 - ✧ product types
 - e.g., diesel, LPG, etc.
 - ✧ flow rates
- Markings must be clear and permanent



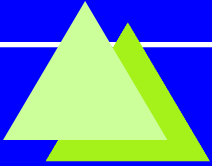
G-UR.3.4. Responsibility, Money-Operated Devices

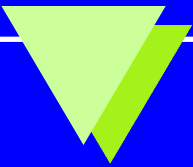
Money-operated devices other than parking meters shall have clearly and conspicuously displayed thereon, or immediately adjacent thereto, adequate information detailing the method for the return of monies paid when the product or service cannot be obtained. This information shall include the name, address, and phone number of the local responsible party for the device. This requirement does not apply to devices at locations where employees are present and responsible for resolving any monetary discrepancies for the customer.

(Amended 1977, 1993)



G-UR.3.4. Responsibility, Money-Operated Devices

- Applies to money-operated devices (other than parking meters)
 - e.g., cash-acceptors interfaced with RMFDs
 - Requires marking of information:
 - method of return of monies when product/service cannot be obtained
 - local party's name, address, and phone number
 - Markings must be clear and conspicuous
 - Does not apply when employees are present
- 



G-S.5. Indicating & Recording Elements - Design

- Primary Indicating or Recording Element
 - element designed to be used in normal commercial use of device
 - used by customer or operator to determine quantity and price of delivery
 - remote readout used by operator to determine final price and quantity is also “primary”
 - ✧ e.g., control console
 - totalizer is not primary since it is not used to determine amount or price of individual sale

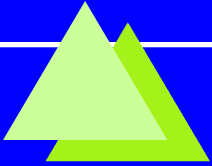


S.1.1. General

- A liquid-measuring device:
 - (a) shall be equipped with a primary indicating element, and
 - (b) may be equipped with a primary recording element.
- Indicating elements necessary to inform buyer and seller of transaction amounts
- Recording elements are a convenience



S.1.2. Units

- S.1.2. Units. - A liquid-measuring device shall indicate, and record if the device is equipped to record, its deliveries in liters, gallons, quarts, pints, or binary- submultiples or decimal subdivisions of the liter or gallon.
(Amended 1987, 1994)
 - S.1.2.1. Retail Motor-Fuel Devices. - Deliveries shall be indicated and recorded, if the device is equipped to record, in liters or gallons and decimal subdivisions or fractional equivalents thereof.
(Added 1979)
- 



S.1.2.3. Value of Smallest Unit

The value of the smallest unit of indicated delivery, and recorded delivery if the device is equipped to record, shall not exceed the equivalent of:

- (a) 0.5 L (1 pt) on retail devices;
- (b) 5 L (1 gal) on wholesale devices.

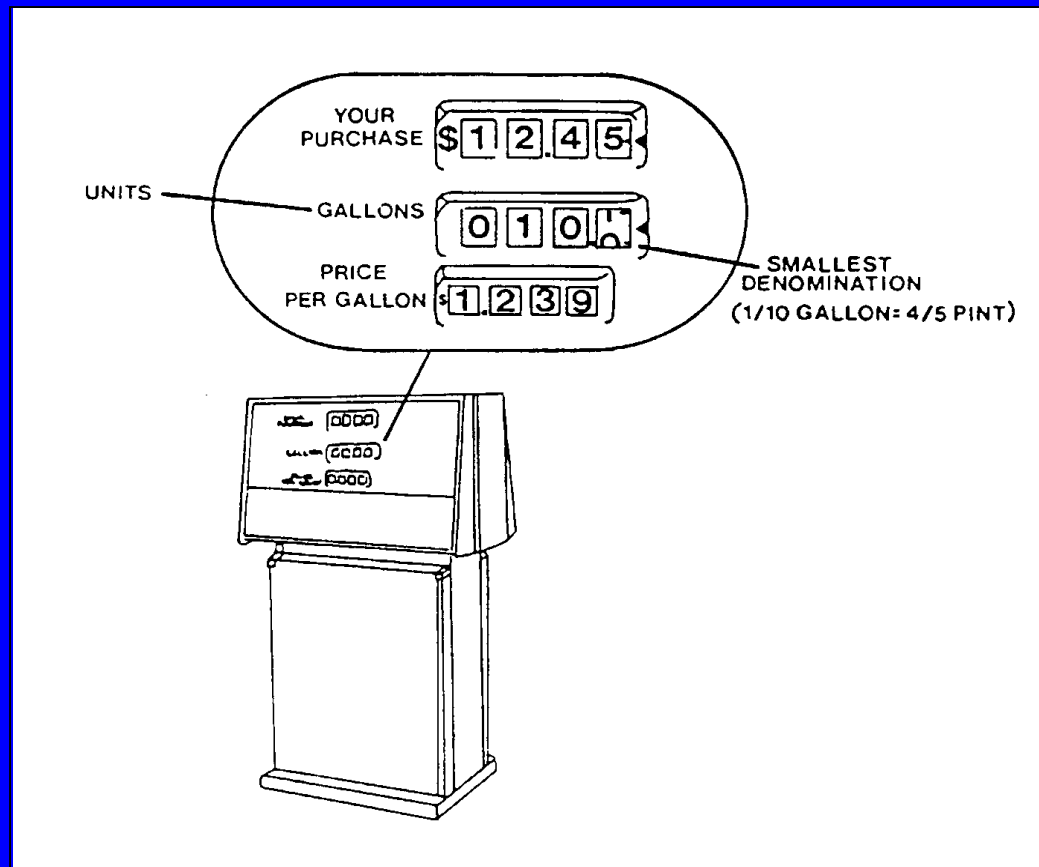
This requirement does not apply to manually operated devices equipped with stops or stroke-limiting means.
(Amended 1983 and 1986)



Units of Measure

- S.1.2. Retail Motor-Fuel Devices
 - liters or gallons
 - decimal or fractional subdivisions
- S.1.2.3. Value of Smallest Unit
 - retail devices
 - one pint = 0.125 gal or smaller
 - wholesale devices
 - one gallon or smaller
 - does not apply to manually operated devices with stops or stroke-limiting means

Figure 5-2. Units Indicated






Determining Compliance with S.1.2.

- Generally determine by visual inspection
 - examine units and denominations
- Be sure to check remote and shared elements
- Be alert to modifications & tampering
 - software modifications
 - unauthorized replacement of chips
 - pulser modifications
 - often not easy to detect without further investigation



Indicating & Recording Elements - Readability

- G-S.5. Indicating and Recording Elements.
 - G-S.5.1. General.
 - G-S.5.2. Graduations, Indications, and Recorded Representations.
 - G-S.5.2.3. Size and Character.
 - G-S.5.2.4. Values.
 - G-S.5.2.5. Permanence.
 - G-S.5.6. Recorded Representations.
 - G-S.6. Marking, Operational Controls, & Features
 - G-S.7. Lettering
- 



Indicating & Recording Elements - Readability

- G-S.5.1. Indicating & Recording Elements, General
 - elements appropriate in design & adequate in amount
 - easy to read & understand in any condition of normal service
- G-S.5.2. Graduations, Indications, Recorded Representations
 - graduations and units uniform in size
 - ✧ subordinate values appropriately designated
 - values defined by words, symbols (e.g., gallons, liters, \$)
 - graduations and defining figures not easily obliterated



Indicating & Recording Elements - Readability

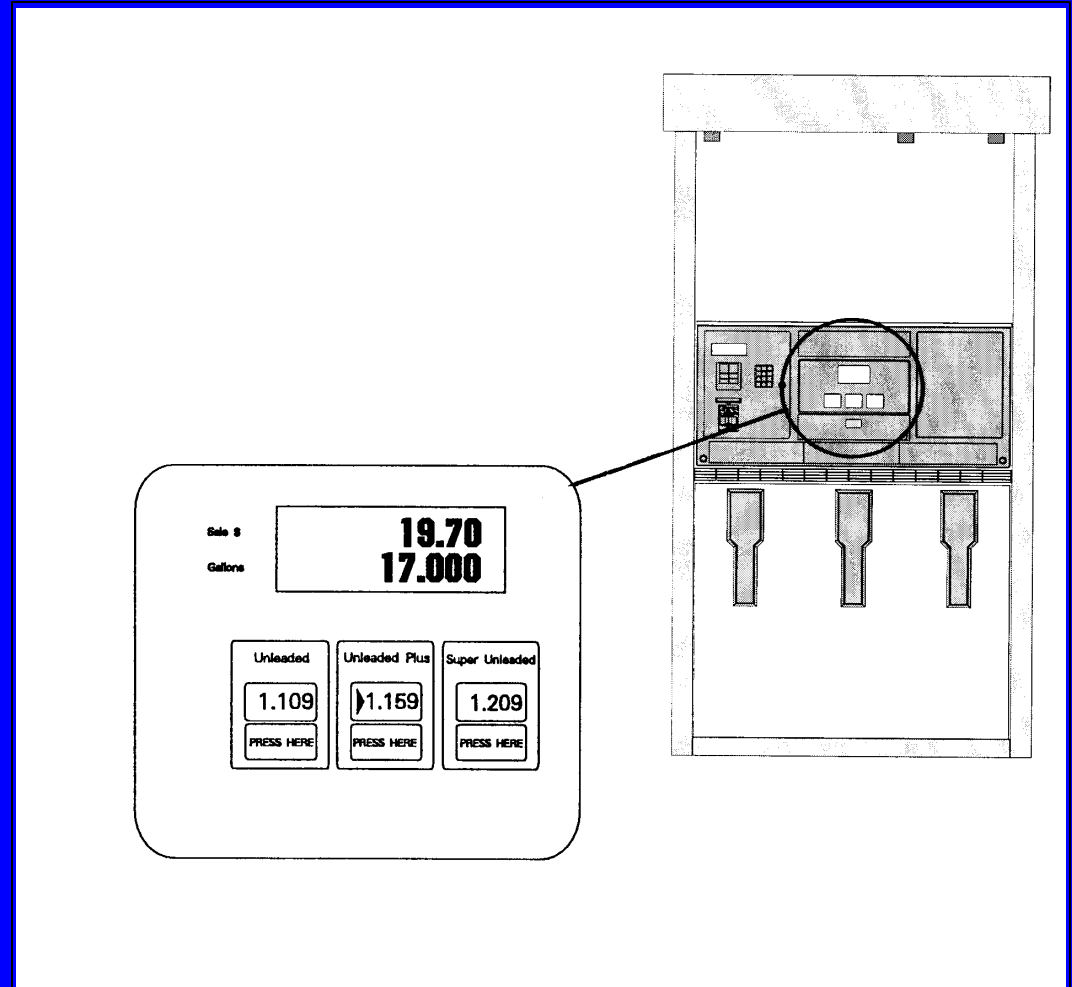
- G-S.5.6. Recorded Representations
 - requirements for indicating/recording elements also apply to recorded representations
 - values must be printed digitally
- G-S.6. Marking Operational Controls, Indications, Features
 - controls, features clearly identified
 - pictograms acceptable
- G-S.7. Lettering
 - required markings distinct & easy to read
 - not easily obliterated



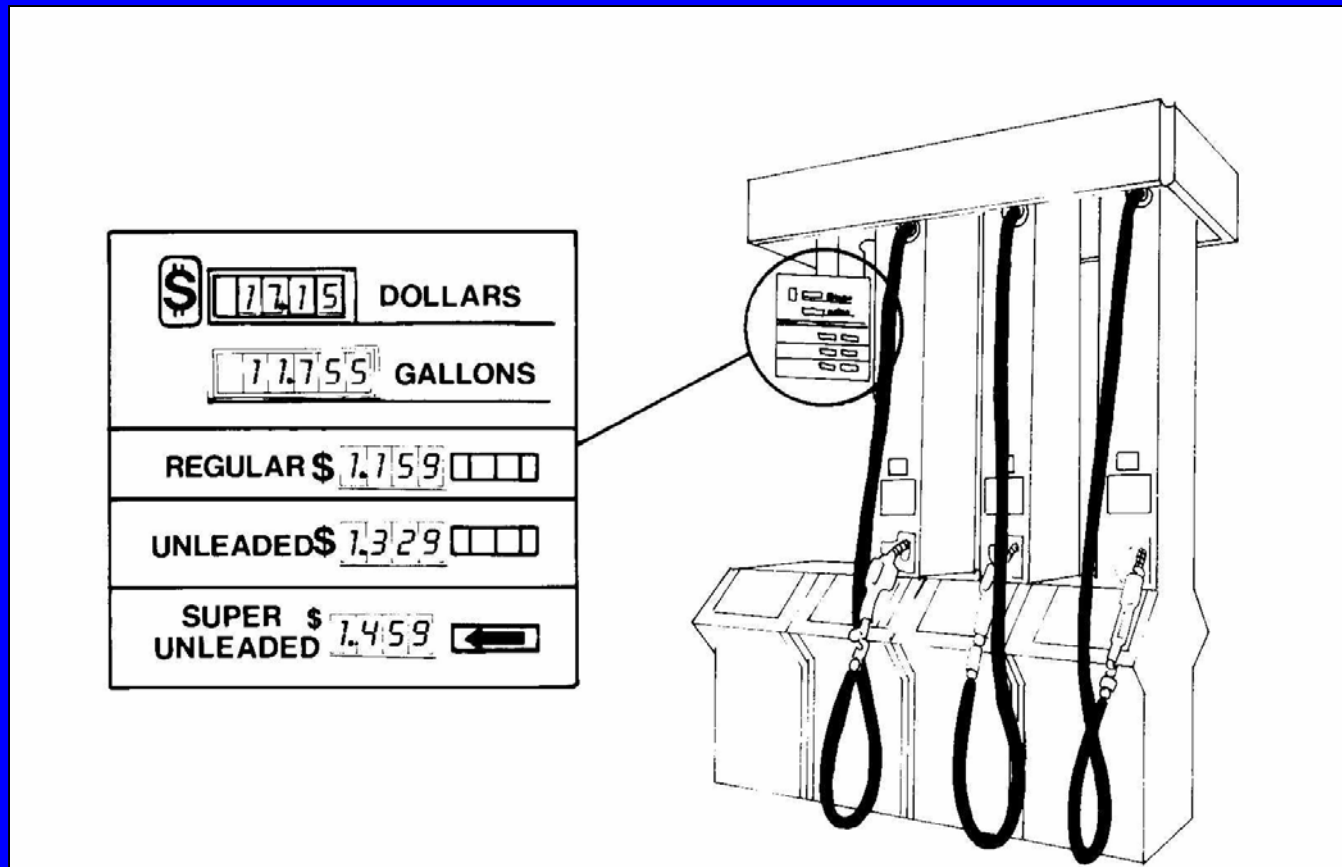
Readability - General

- NTEP verifies areas not practical to verify during routine field examination
 - e.g., width of graduation on mechanical dispenser
- Field examination
 - not obviously outside of requirements
 - no malfunctioning segments, broken components
 - indications must be clear, readable, well-defined
 - ✧ from a reasonable customer position
 - ✧ readily understandable

Figure 5-3. Multi-Product Dispenser with Shared Electronics



Multi-Product Dispenser with Shared Electronics - Example

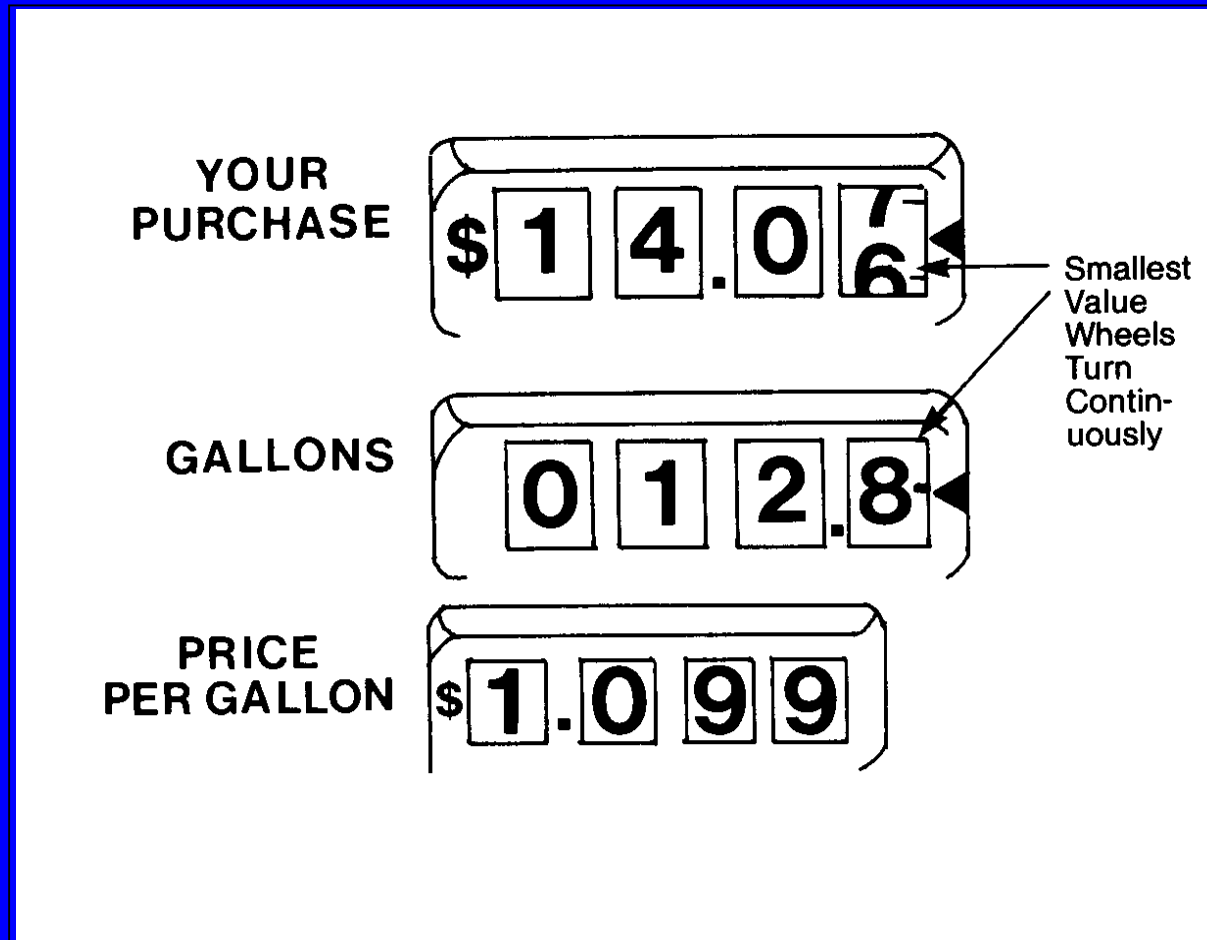




Definition - Analog Type

analog type. A system of indication or recording in which values are presented as a series of graduations in combination with an indicator, or in which the most sensitive element of an indicating system moves continuously during the operation of the device. [1.10]

Figure 5-4. Graduated Intervals





Definition - Digital Type

- digital type.- A system of indication or recording of the selector type or one that advances intermittently in which all values are presented digitally, or in numbers. In a digital indicating or recording element, or in digital representation, there are no graduations. [1.10]
- Increment is smallest change in value that can be indicated



Indicating & Recording Elements - Values of Intervals

- S.1.4. Graduations

- length
- width
- clear interval
between graduations

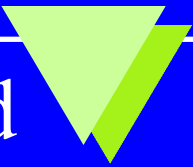
- S.1.5. Indicators

- symmetry
- length
- width
- clearance
- parallax

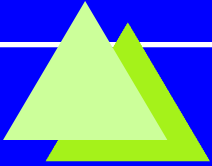


Values of Graduated Intervals or Increments

- G-S.5.3. Values of Graduated Intervals or Increments. - In any series of graduations, indications, or recorded representations, the values of the graduated intervals or increments shall be uniform throughout the series.
- G-S.5.3.1. On Devices That Indicate or Record in More Than One Unit. - On devices designed to indicate or record in more than one unit of measurement, the values indicated and recorded shall be identified with an appropriate word, symbol, or abbreviation.
[Made retroactive 1990] (Amended 1978, 1986)



Verifying Values of Graduated Intervals or Increments

- Analog
 - graduated intervals are equal
 - difference between successive values is equal
 - then, values are uniform
 - Digital
 - difficult to verify in field
 - spot check quantity & price in absence of complaints or evidence of tampering
 - Dual Units (e.g., gallons/liters)
 - permitted if properly identified
- 



S.1.6.1. Indication of Delivery

The device shall automatically show on its face the initial zero condition and the quantity delivered (up to the nominal capacity).

However, the first 0.03 L (or 0.009 gal) of a delivery and its associated total sales price need not be indicated.

(Amended 1982)



S.1.6.1. Indication of Delivery

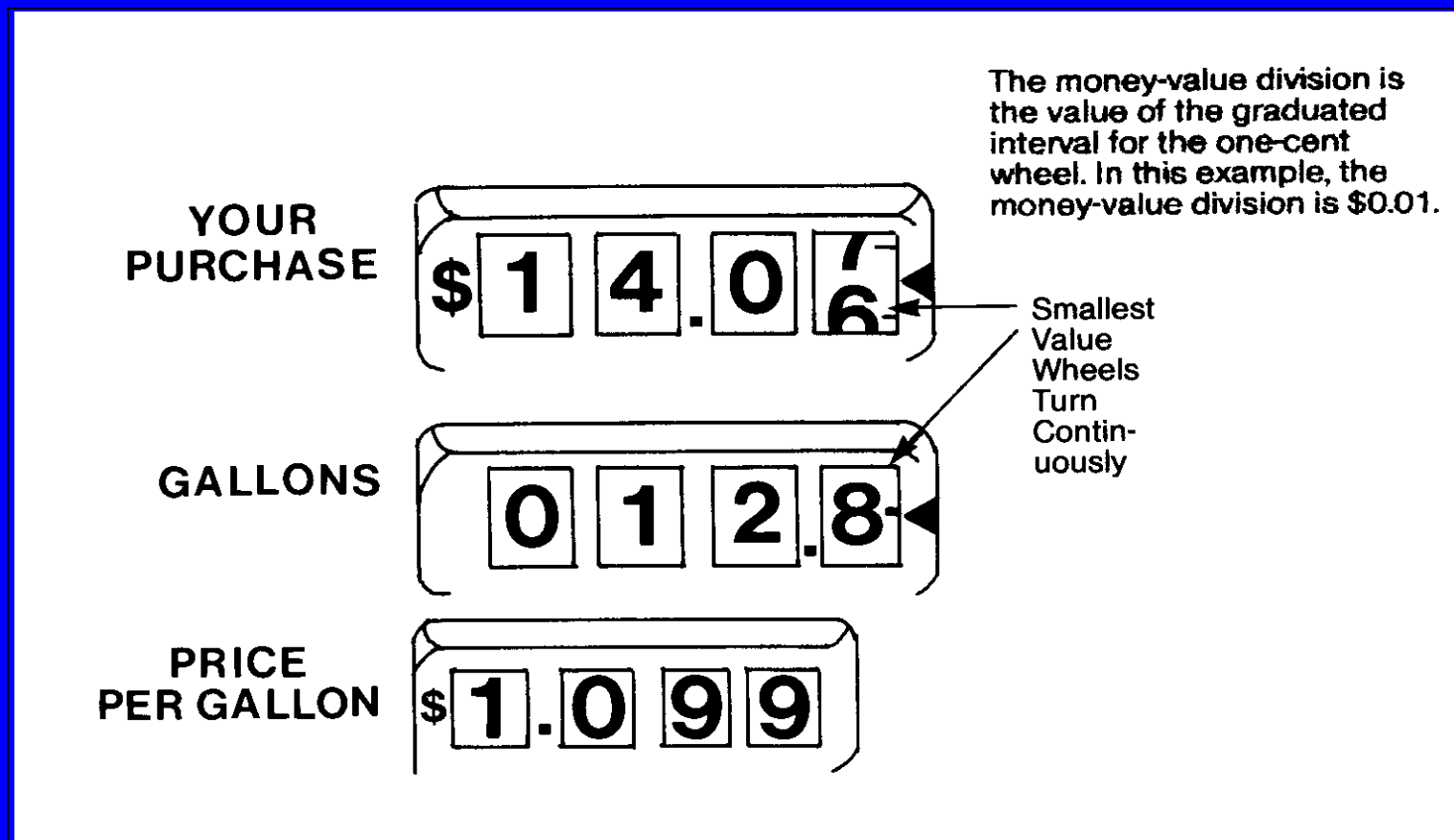
- Must display quantity from zero to final quantity
- First 0.009 gal & associated price may be suppressed
 - small quantity when dispenser switched on
 - usually due to computer jump
 - only display of quantity may be suppressed



Money-Value Division

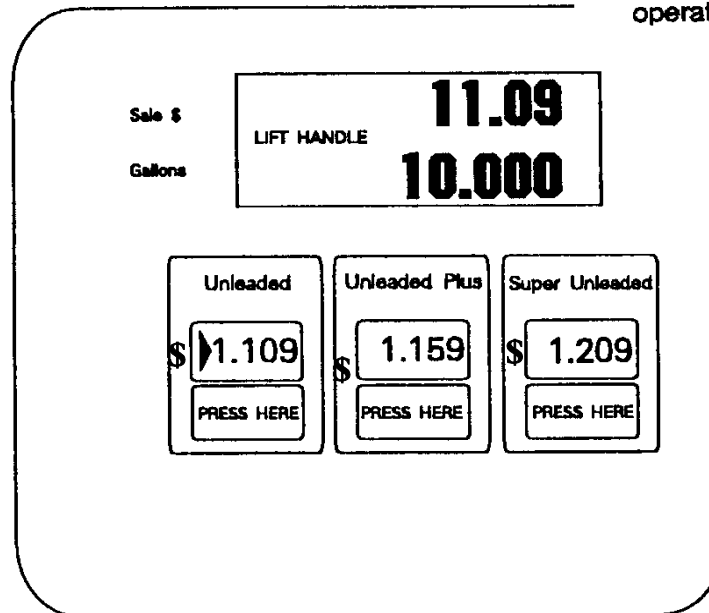
- Smallest computed price that can be indicated
- Analog:
 - smallest price wheel
- Digital:
 - smallest increment of price that can be displayed

Money-Value Divisions - Analog



Money-Value Divisions - Digital

The money-value division is the smallest *increment* (i.e., the smallest change in price) that can be indicated. It can only be determined by observing the display while the dispenser is operating.





S.1.6.5.1. Money-Value Divisions, Analog

The values of the graduated intervals representing money values on a computing type device shall be those in Table 1.
(Amended 1991)

Table 1.
Money-Value Divisions and
Maximum Allowable Variations for Money-Value
Computations on Mechanical Analog Computers

| Unit Price | | Money Value Division | Maximum Allowable Variation | |
|--------------------------------|---------------------------------|-------------------------|--------------------------------|---------------|
| From | To and including | | Design Test | Field Test |
| 0 | 0.25/liter or \$1.00/gallon | 1¢ | ± 1¢ | ± 1¢ |
| 0.25/liter or \$1.00/gallon | 0.75/liter or \$3.00/gallon | 1¢ or 2¢ | ± 1¢ | ± 2¢ |
| 0.75/liter or \$3.00/gallon | 2.50/liter or \$10.00/gallon | 1¢ or 2¢ | ± 1¢ | ± 2¢ |
| 0.75/liter or \$3.00/gallon | 2.50/liter or \$10.00/gallon | 5¢ | ± 2 1/2¢ | ± 5¢ |



Money-Value Divisions - Analog

- Table 1 allows 2 and 5 cent increments for higher unit prices
- Added in response to increased unit prices in 1970s
 - mechanical computers could not compute above \$0.999/gal
- Increased use of electronic devices largely eliminated need for 2 and 5 cent increments



S.1.6.5.2. Money-Value Divisions - Digital

A computing type device with digital indications shall comply with the requirements of paragraph G.S.5.5. Money Values, Mathematical Agreement, and the total price computation shall be based on quantities not exceeding 0.05 L for devices indicating in metric units and 0.01-gal. intervals for devices indicating in inch-pound units.

(Added 1980)





S.1.6.5.2. Money-Value Divisions - Digital

- Applies to computing type device with digital indications
- Shall comply with G-S.5.5. Money Values, Mathematical Agreement
- Total price computations based on no greater than 0.01 gal increments



G-S.5.5. Money Values, Mathematical Agreement

Any recorded money value and any digital money- value indication on a computing-type weighing or measuring device used in retail trade shall be in mathematical agreement with its associated quantity representation or indication to the nearest 1 cent of money value. This does not apply to auxiliary digital indications intended for the operator's use only, when these indications are obtained from existing analog customer indications that meet this requirement.

(Amended 1973)



Money-Value Division Based on Qty Increment & Unit Price

Quantity value increment is 0.01 gal
Money value division is \$ 0.01

| Quantity | | Price |
|----------|-------------|---------------------------|
| 1.00 gal | @\$1.00/gal | \$1.00 |
| 1.01 | | 1.01 |
| 1.02 | | 1.02 |
| | | |
| 1.00 gal | @\$1.50/gal | \$1.50 |
| 1.01 | | 1.52 (\$1.515 rounded up) |
| 1.02 | | 1.53 |
| 1.03 | | 1.55 (\$1.545 rounded up) |



Effect of 0.01 Gallon Increment on Money-Value Division

- Increment is always rounded to nearest cent
 - Thus, effective money-value increment is \$0.01 or \$0.02, depending on unit price
 - What if customer wants specific dollar amount?
- Quantity increments of 0.001 gal will eliminate problems with money value divisions greater than \$0.01



S.1.6.5.3. Auxiliary Elements

If a system is equipped with auxiliary indications, all indicated money value divisions of the auxiliary element shall be identical with those of the primary element.
[Nonretroactive and enforceable as of January 1, 1985.]



S.1.6.5.3. Auxiliary Elements

- Money value divisions on auxiliary elements must be same as on primary element
- Example:
 - dispenser with analog indicator has money-value increments of \$0.02
 - digital control console must also have money-value increments of \$0.02



S.1.6.4.1. Unit Price.

(a) A computing or money-operated device shall display on each face the unit price at which the device is set to compute or to dispense.

(b) Whenever a grade, brand, blend, or mixture is offered for sale from a device at more than one unit price, then all of the unit prices at which that product is offered for sale shall be displayed or shall be capable of being displayed on the dispenser using controls available to the customer prior to the delivery of the product. It is not necessary that all of the unit prices for all grades, brands, blends, or mixtures be simultaneously displayed prior to the delivery of the product. This subsection shall not apply to fleet sales, other contract sales, or truck refueling sales (e.g., sales from dispensers used to refuel trucks).

[Effective and nonretroactive as of January 1, 1991.]

(Amended 1989 and 1997)





S.1.6.4.2. Product Identity.

- (a) A device shall be able to conspicuously display on each side the identity of the product dispensed.
- (b) A device designed to dispense more than one grade, brand, blend, or mixture of product shall be able to display on each side the identity of the grade, brand, blend, or mixture being dispensed.



S.1.6.5.4. Selection of Unit Price.

Except for dispensers used exclusively for fleet sales, other price contract sales, and truck refueling (e.g., truck stop dispensers used only to refuel trucks), when a product or grade is offered for sale at more than one unit price through a computing device, the selection of the unit price shall be made prior to delivery using controls on the device or other customer-activated controls. A system shall not permit a change to the unit price during delivery of product.

*[Effective and nonretroactive as of January 1, 1991.]
(Added 1989)(Amended 1991, 1992, 1993, and 1996)*



S.1.6.5. Money-Value Computations.

(a) A computing device shall compute the total sales price at any single-purchase unit price (i.e., excluding fleet sales, other price contract sales, and truck stop dispensers used only to refuel trucks) for which the product being measured is offered for sale at any delivery possible within either the measurement range of the device or the range of the computing elements, whichever is less.

[Effective and nonretroactive as of January 1, 1991].

(b) The analog sales price indicated for any delivered quantity shall not differ from a mathematically computed price (quantity x unit price = total sales price) by an amount greater than the value in Table 1.

(Amended 1984, 1989, and 1993)



UR.3.3. Computing Device.

(a) Any computing device used in an application where a product or grade is offered for sale at more than one unit price (excluding fleet sales and other price contract sales), shall be used only for sales for which the device computes and displays the sales price for the selected transaction.

(Added 1989) (Amended 1992)

(Became Retroactive 1999)

(b) A truck stop dispenser used exclusively for refueling trucks is exempt from the requirements in (a) if all purchases of fuel are accompanied by a printed receipt of the transaction containing the applicable price per gallon, the total gallons delivered, and the total price of the sale.

(Added 1993)





UR.3.3. Computing Device.

(c) Unless a truck stop dispenser used exclusively for refueling trucks complies with S.1.6.4.1. (Display of Unit Price), the price posted on the dispenser and the price at which the dispenser is set to compute shall be the highest price for any transaction which may be conducted.

(Added 1993)



UR.3.2. Unit Price & Product Identity.

(a) The following information shall be conspicuously displayed or posted on the face of a retail dispenser in direct sale:

(1) except for dispensers exclusively for fleet sales, other price contract sales, and truck refueling (e.g., truck stop dispensers used only to refuel trucks), all of the unit prices at which the product is offered for sale; and

(2) in the case of a computing type or money-operated type, the unit price at which the dispenser is set to compute.

Provided that the dispenser complies with S.1.6.4.1., it is not necessary that all the unit prices for all grades, brands, blends, or mixtures be simultaneously displayed or posted.



UR.3.2. (b) Unit Price & Product Identity.

(b) The following information shall be conspicuously displayed or posted on each side of a retail dispenser used in direct sale.

(1) the identity of product in descriptive commercial terms, and

(2) the identity of the grade, brand, blend, or mixture that a multi-product dispenser is set to deliver.



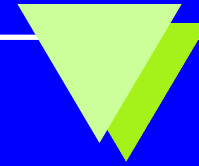
Multiple Unit Price Dispensers

- Developed in response to multi-tier pricing structures
 - e.g., cash/credit
- Designed to eliminate errors in calculating price discounts
 - eliminate need for manual calculations
- Facilitate customer understanding of price calculation
- H44 includes specific requirements relative to display and selection of unit prices



Unit Price Requirements - Display

- S.1.6.4.1.(a)
 - display on each side unit price at which computing device is set to compute
- S.1.6.4.1.(b)
 - multiple unit price dispensers
 - grade, brand, blend or mixture offered for sale at more than one unit price
 - ✧ all unit prices displayed OR
 - ✧ all unit prices capable of being displayed using customer controls
 - ✧ simultaneous display of all unit prices not required



Unit Price Requirements -Display (cont)

- UR.3.2. (a)

- Posted on each face:
 - All unit prices offered for sale
 - except dispensers used exclusively for fleet/contract/truck refueling
 - Unit price at which computing device is set to compute
- Simultaneous display of unit prices not required on dispensers complying with S.1.6.4.1.





Unit Price Requirements - Selection

- S.1.6.5.4. Selection of Unit Price
 - applies to devices offering product at more than one unit price
 - does not apply to fleet, price contract, truck refueling
 - selection of unit price made prior to delivery
 - selection made using controls on device or other customer-activated controls
 - system shall prevent unit price change during delivery



Computing Capability

- S.1.6.5. Money-Value Computations
 - Computing device shall compute total sales at any unit price for which product is being sold
 - does not apply to fleet, price contract
- Notes:
 - companies can still dedicate dispensers for selling at a single unit price
 - ✧ same product can be sold at different unit prices



Computing Capability (cont)

- UR.3.3. Computing Device

- Device shall only be used for sales for which device computes and displays total price
 - ✧ Devices exclusively used to refuel trucks
 - Exempt from above -- if receipt provided with transaction info
 - Must display highest unit price unless it complies with S.1.6.4.1. (display of unit price)
- Became retroactive 1999
- To ensure device is suitable for application with respect to computation capability



Product Identity Requirements

- S.1.6.4.2.
 - Display on each side identity of product dispensed
 - Devices designed to dispense more than one grade, brand, blend, or mix must display identity of grade, brand, blend, or mix on each side
- UR.3.2. (b)
 - Identity of product on each side
 - Identity of grade, brand, blend, or mix that multi-product dispenser is set to deliver



S.1.6.3. Return to Zero


- (a) The primary indicating and recording elements if the device is equipped to record, shall be readily returnable to a definite zero indication. However, a key -lock operated or other self-operated device may be equipped with cumulative indicating or recording elements, provided it also has a zero return indicating element.
- (b) It shall not be possible to return primary indicating elements or primary recording elements beyond the correct zero position.



UR.3.1. Return of Indicating and Recording Elements to Zero

On any dispenser used in making retail deliveries, the primary indicating element, and recording element if so equipped, shall be returned to zero before each delivery.

Exceptions to this requirement are totalizers on key-lock- operated or other self-operated dispensers and the primary recording element if the device is equipped to record.






Return to Zero

- S.1.6.3.
 - Device shall be readily returnable to zero indication
 - Exception is key-lock, self-operated with cumulative indicating element
 - Shall not be possible to return indications beyond zero
- UR.3.1.
 - Requires user/operator to return indicating elements (and recording elements if equipped) to zero before each delivery



S.1.3. Advancement of Indicating & Recording Elements

It shall not be possible to advance primary indicating and recording elements except by the mechanical operation of the device. Clearing a device by advancing its elements to zero is permitted, but only if:

- (a) once started, the advancement movement cannot be stopped until zero is reached, and
 - (b) in the case of indicating elements only, such elements are automatically obscured until the elements reach the correct zero position.
- 



S.1.3. Advancement of Indicating & Recording Elements

- Advancement must be accomplished by operation of device
 - only while fuel is being delivered
- Clearing by advancing elements permitted:
 - once started, does not stop till zero is reached
 - indications obscured until elements reach zero
 - ✧ blanking or shutters



S.2.5. Zero-Set-Back Interlock, Retail Motor-Fuel Devices

A device shall be constructed so that:

(a) after a delivery cycle has been completed by moving the starting lever to any position that shuts off the device, an automatic interlock prevents a subsequent delivery until the indicating elements, and recording elements if the device is equipped and activated to record, have been returned to their zero positions;



S.2.5. Zero-Set-Back Interlock, Retail Motor-Fuel Devices (cont)

- (b) the discharge nozzle cannot be returned to its designed hanging position (that is, any position where the tip of the nozzle is placed in its designed receptacle and the lock can be inserted) until the starting lever is in its designed shut-off position and the zero-set-back interlock has been engaged; and
- (c) in a system with more than one dispenser supplied by a single pump, an effective automatic control valve in each dispenser prevents product from being delivered until the indicating elements on that dispenser are in a correct zero position.

(Amended 1981 and 1985)





S.2.5. Zero-Set-Back Interlock, Retail Motor-Fuel Devices

- Automatically resets dispenser before next delivery
- Interlock through “on/off” mechanism
- Discharge nozzle cannot be returned to designed hanging position until
 - starting lever in shut-off position
 - zero set-back interlock is engaged
- Systems with more than one dispenser supplied by single pump prevents product delivery until indicating elements returned to zero



G-S.8. Provision for Sealing, Electronic Adjustable Components

A device shall be designed with provision(s) for applying a security seal that must be broken, or for using other approved means of providing security (e.g., data change audit trail available at the time of inspection), before any change that detrimentally affects the metrological integrity of the device can be made to any electronic mechanism. [Nonretroactive as of January 1, 1990.]

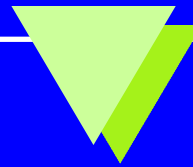
A device may be fitted with an automatic or a semi- automatic calibration mechanism. This mechanism shall be incorporated inside the device. After sealing, neither the mechanism nor the calibration process shall facilitate fraud.

(Added 1985)(Amended 1989 and 1993)



G-UR.4.5. Security Seal

A security seal shall be appropriately affixed to any adjustment mechanism designed to be sealed.



S.2.2. Provision for Sealing

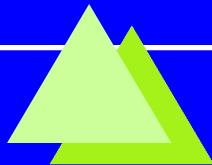
Adequate provision shall be made for an approved means of security (e.g., data change audit trail) or physically applying security seals in such a manner that no adjustment may be made of:

- (a) any measurement element, or
- (b) any adjustable element for controlling delivery rate when such rate tends to affect the accuracy of deliveries.

When applicable, the adjusting mechanism shall be readily accessible for purposes of affixing a security seal.

(c) *Audit trails shall use the format set forth in Table S.2.2. [Nonretroactive and enforceable as of January 1, 1995.]*

(Amended 1991, 1993, and 1995)





Security Seals & Provisions for Sealing

- G-S.8. Provision for Sealing, Electronic
 - requires device to be designed with provision to apply security seal
 - ✧ physical seal or other approved means (e.g., audit trail)
 - seal protects against metrological changes
- G-UR.4.5. Security Seal
 - security seal must be affixed to adjustment mechanism designed to be sealed



Security Seals & Provisions for Sealing

- S.2.2. Provision for Sealing
 - provision for approved means of security on:
 - ✧ measurement element
 - ✧ adjustable element for controlling delivery rates when rates affect accuracy
 - adjusting mechanism readily accessible
 - audit trails as specified in Table S.2.2.



Security Seals & Provisions for Sealing - Table S.2.2.

- Category 1:
 - no remote configuration
 - **Sealing:**
 - ✧ physical seal or two event counters
- Category 2:
 - remote configuration, but access controlled by hardware
 - Sealing:
 - physical seal on hardware or two event counters
 - clear indication when in calibration mode



Security Seals & Provisions for Sealing - Table S.2.2.

- Category 3:
 - remote configuration, access unlimited or controlled through software switch
 - **Sealing:**
 - event logger required
- Note: As of 2005, all devices with remote configuration must meet Category 3.



Audit Trails - General

- Most RMFDs fall under Category 1 or 2
- Details on accessing audit trail for a device:
 - NTEP CC
 - manufacturer or service company
- Record audit trail readings on inspection report
 - compare event counter readings from past inspections
 - high number of changes may warrant further investigation



S.1.6.7. Recorded Representations, Point-of-Sale Systems.

Except for fleet sales and other price contract sales, a printed receipt providing the following information shall be available through a built-in or separate recording element for all transactions conducted with point-of-sale systems or devices activated by debit cards, credit cards, and/or cash:

- (a) the total volume of the delivery,*
- (b) the unit price,*
- (c) the total computed price, and*
- (d) the product identity by name, symbol, abbreviation, or code number.*

[Nonretroactive as of January 1, 1986.]

(Added 1985) (Amended 1997)





S.2.1. Vapor Elimination

- (a) A liquid-measuring device shall be equipped with a vapor or air eliminator or other automatic means to prevent the passage of vapor and air through the meter.
- (b) Vent lines from the air or vapor eliminator shall be made of metal tubing or other rigid material.
- (Amended 1975)

Vapor Elimination


- meter will measure vapor if it is not removed
- S.2.1. Requires LMD to be equipped with vapor or air eliminator or other automatic means
 - to prevent passage of vapor through meter
- vent lines made from metal or rigid material
 - crimping or blocking will obstruct vapor elimination
 - ✧ can result in measurement of vapor
 - breaks or punctures can create hazards
 - must open cabinet to inspect self-contained, suction-pump dispenser



S.3. Discharge Lines and Valves

S.3.1. Diversion of Measured Liquid

No means shall be provided by which any measured liquid can be diverted from the measuring chamber of the meter or its discharge line. Two or more delivery outlets may be installed only if automatic means are provided to ensure that:

- (a) liquid can flow from only one outlet at a time, and
 - (b) the direction of flow for which the mechanism may be set at any time is clearly and conspicuously indicated.
- (continued....)
- 



S.3.1. Diversion of Measured Liquid (cont)

A manually controlled outlet that may be opened for purging or draining the measuring system or for recirculating product in suspension shall be permitted only when the system is measuring food products or agri-chemicals. Effective means shall be provided to prevent passage of liquid through any such outlet during normal operation of the measuring system and to inhibit meter indications (or advancement of indications) and recorded representations while the outlet is in operation.

(Amended 1991, 1995, and 1996)





S.3.2. Exceptions

S.3.2. Exceptions. - The provisions of S.3.1. Diversion Prohibited shall not apply to truck refueling devices when diversion of flow to other than the receiving vehicle cannot readily be accomplished and is readily apparent. Allowable deterrents include, but are not limited to, physical barriers to adjacent driveways, visible valves, or lighting systems that indicate which outlets are in operation, and explanatory signs;
(Amended 1982, 1990, 1991, and 2002)



S.3.1. Diversion

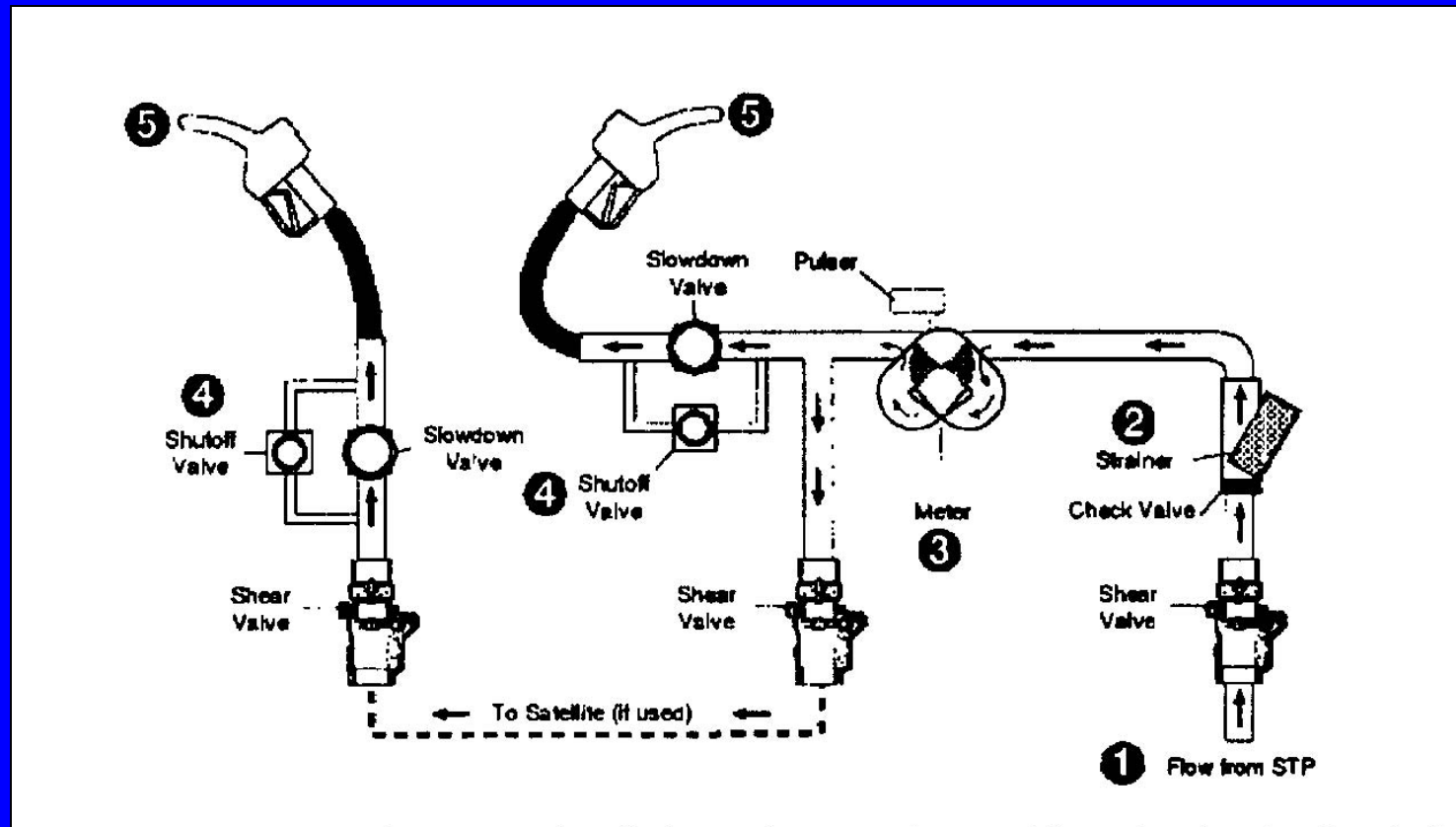
- prohibits lines which can divert product after meter
- two outlets permitted if:
 - liquid flows from only one at a time
 - direction of flow clearly indicated
- manually operated line for purging or servicing is permitted for food and agri-chemical products
- means provided to prevent passage in normal operation



S.3.2. Exceptions

- Truck refueling devices
 - satellite systems
 - must include deterrents
 - ✧ physical barriers, lighting systems, visible valves, signs

Figure 5-7 Satellite System





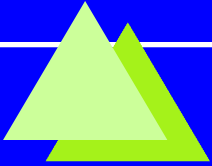
Discharge Line

- S.3.3. Pump Discharge Unit. - A pump-discharge unit equipped with a flexible discharge hose shall be of the wet-hose type.
- S.3.5. Discharge Hose. - A discharge hose shall be reinforced so that the performance of the device is not affected by the expansion or contraction of the hose.



S.3.6. Discharge Valve.

A discharge valve may be installed in the discharge line only if the device is of the wet-hose type. Any other shutoff valve on the discharge side of the meter shall be of the automatic or semi automatic predetermined-stop type or shall be operable only:

- (a) by means of a tool (but not a pin) entirely separate from the device, or
 - (b) by mutilation of a security seal with which the valve is sealed open.
- 



S.3.7. Antidrain Means.

In a wet-hose pressure- type device, means shall be incorporated to prevent the drainage of the discharge hose.
(Amended 1990)



UR.1.1. Discharge Hose

UR.1.1.1. Length

The length of the discharge hose on a retail motor-fuel device:

- (a) shall be measured from its housing or outlet of the discharge line to the inlet of the discharge nozzle;
- (b) shall be measured with the hose fully extended if it is coiled or otherwise retained or connected inside a housing; and
- (c) shall not exceed 5.5 m (18 ft) unless it can be demonstrated that a longer hose is essential to permit deliveries to be made to receiving vehicles or vessels.

An unnecessarily remote location of a device shall not be accepted as justification for an abnormally long hose.

(Amended 1972 and 1987)





UR.1.1. Discharge Hose

UR.1.1.2. Marinas and Airports.

UR.1.1.2.1. Length. - The length of the discharge hose shall be as short as practicable, and shall not exceed 15 m (50 ft) unless it can be demonstrated that a longer hose is essential.

UR.1.1.2.2. Protection. - Discharge hoses exceeding 8 m (26 ft) in length shall be adequately protected from weather and other environmental factors when not in use.
(Made retroactive 1974 and amended 1984)



Discharge Hose

- Pump discharge system must be “wet-hose” type
 - full of liquid at all times
 - “dry-hose” type is drained of liquid after each use
- Improperly reinforced hose
 - can cause “computer jump”
 - ✧ computer registers small amount before fuel is delivered
 - ✧ expansion and contraction during nonuse and exposure to sun, wind, etc.
 - can rupture
- Excessively long hose can also cause computer jump



Discharge Hose Length

- UR.1.1.1.
 - No longer than 18 feet for RMFDs
- UR.1.1.2.
 - Exception for airports & marinas
 - ✧ maximum of 50 feet
 - ✧ longer than 26 feet must be protected



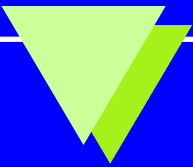
Discharge Hose

- S.3.6. Discharge Valve

- discharge valve only permitted in “wet-hose” type
 - ✧ must be at end of discharge line
- any other valve must be automatic or semi-automatic or:
 - ✧ operable only by tool separate from device
 - ✧ operable only by mutilation of security seal

- S.3.7. Antidrain Means

- required in “wet-hose” type
- prevents drainage of hose between deliveries
 - ✧ prevents overcharge of next customer when hose re-pressurizes and fills with liquid



Chapter 5 - Summary

- EPOs 21 & 22
- General Considerations
- Marking Requirements
- Indicating & Recording Elements
- Discharge Hose
- Measuring Elements